RMRS Rocky Mountain Remediation Services, L L C
protecting the environment

PROCEDURE

GROUNDWATER SAMPLING	Procedure No RMRS/OPS PRO 113 Revision 0 Date effective 03/01/99

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Manager Water Operations/Waste Operations Division Date

USE CATEGORY 2

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1 0 PURPOSE

This standard operating procedure (SOP) describes procedures that will be used at the Rocky Flats Environmental Technology Site (RFETS) to sample groundwater from monitoring wells Monitoring wells are currently sampled on a semi annual quarterly or monthly basis or by special request in support for specific projects All new wells to be installed in the future will be sampled following these procedures

This SOP describes equipment decontamination and transport, site preparation, detection and sampling of immiscible layers water level measurements well purging, sample collection field and analytical parameters quality assurance/quality control (QA/QC) requirements and documentation that will be used for field data collection

2 0 SCOPE

This document, which supersedes groundwater SOP GW 06 applies to all Rocky Mountain Remediation Services (RMRS) personnel and subcontractors conducting groundwater-related work at the RFETS This (SOP) describes acceptable methods for the sampling of wells and piezometers installed at RFETS

3 0 RESPONSIBILITIES AND QUALIFICATIONS

Personnel performing groundwater sampling procedures are required to have completed the initial 40-hour OSHA classroom training that meets the Department of Labor requirements 29 CFR 1910 120(e)(3)(i), and must maintain a current training status by completing the appropriate annual 8-hour OSHA refresher courses Personnel must also have read and signed the appropriate Health and Safety Plan(s) Prior to engaging in groundwater sampling activities, personnel must have a complete understanding of the procedures described within this SOP and, if necessary, will be given specific training regarding these procedures by other personnel experienced in the methods described within this SOP

4 0 GROUNDWATER SAMPLING PROCEDURES

4 1 Introduction

The monitoring wells currently active at the RFETS include wells installed from 1986 through the present time which are constructed of either 2-inch stainless steel, or 2 or 4-inch flush threaded PVC casing Some piezometers have been completed as monitoring wells that are usually constructed of ¾ inch inside diameter, flush threaded PVC casing Since 1989, wells have been constructed to incorporate a sump below the well screen Since these vary in length, the well construction diagrams should be consulted to determine the sump lengths for specific wells Most piezometers are constructed with a flush threaded cap at the bottom of the well screen However, the well construction diagrams should also be consulted for information about specific piezometers

Procedures for groundwater sampling are designed to obtain a sample that is representative of the formation water beneath the site in question Since an analysis of the quality of formation water is desired, standing water within the well must be purged before sampling Also a measure of the static water elevations is important to determine the effect of seasonal horizontal and vertical flow gradient changes during site characterization activities

Groundwater sampling procedures can be initiated after taking the required water level measurements (SOP RMRS/OPS PRO 105 Water Level Measurements in Wells and Piezometers) and purging the well in accordance with this SOP Methods for accomplishing each of these activities are included in this SOP in the following sequence

- Collection of immiscible layers samples, if present
- Well purging
- Groundwater sampling using a bailer
- Groundwater sampling using a peristaltic pump
- Groundwater sampling with a bladder pump

4.2 General Equipment Requirements

Down-hole sampling equipment will be constructed of inert material such as polytetrafluoroethylene (Teflon®) or stainless steel. This equipment will be assessed on an individual basis prior to use in the field.

The following is a primary list of well sampling and associated equipment:

- Bailers - Teflon®, stainless steel, or other appropriate inert materials
- Teflon® coated stainless steel cable with reels
- Peristaltic pumps and tubing
- Water level measuring devices - sufficiently accurate to measure water levels to the nearest 0 01 foot
- Graduated purge water containers
- Plastic sheeting
- Distilled or deionized water
- Decontamination equipment and supplies
- Organic vapor detector (OVD)
- Gloves (nitrile)
- Calculator and watch
- Sample containers precleaned to EPA specifications
- pH paper
- Custody tape
- Coolers with sufficient blue ice to cool samples to 4°C
- Preservatives (trace metals grade)
- Disposable in-line 0 45-micron membrane filters
- Logbooks and field forms
- Black waterproof pens
- Portable laboratory equipment for measuring field parameters for pH, temperature, specific conductance, and turbidity
- Total alkalinity reagent
- Beakers and graduated cylinders

Additional equipment may be required, to meet the subcontractor's health and safety standards, perform specialized sampling and meet personnel and equipment decontamination requirements

4 3 Equipment Decontamination and Transport

Guidelines presented in SOP RMRS/OPS-PRO 127, Field Decontamination Operations, will be followed for decontaminating equipment involved in groundwater sampling operations. Equipment associated with the tasks involved in groundwater sampling will be decontaminated upon arrival at RFETS prior to use in the field. All sampling equipment will be decontaminated between sample locations If field conditions require more frequent decontamination the frequency will be increased appropriately

Transportation of all equipment will be performed in a manner that eliminates any possibility of cross-contamination Calibration solutions fuel decontamination solutions and wastewater and all other sources of contamination will be segregated from sampling equipment during transport. Purge water being transported to holding areas will be kept in closed containers

If the decontamination of downhole equipment is not performed at the well, used downhole equipment will be wrapped in plastic sheeting and/or segregated from clean equipment to eliminate the possibility of cross contamination The equipment will then be decontaminated as soon as possible

4 3 1 *Routine Field Decontamination*

Decontamination of delicate equipment and the routine decontamination of sampling equipment prior to use at each well will consist of the following steps

- The equipment will be vigorously scrubbed with a brush and solution of phosphate-free laboratory grade detergent (e g Liquinox) and distilled water

- The equipment will then be rinsed thoroughly with approved distilled water

- If the decontaminated equipment will not immediately be packaged to eliminate any adhesion of airborne impurities an additional final rinse or decontamination and rinse should be performed immediately prior to actual sampling operations

4 3 2 *Routine Decontamination of Sampling Pumps*

The external surfaces of all non-dedicated pumping equipment will be decontaminated as described in Subsection 4 3 1 Internal surfaces will be decontaminated according to the following procedures, except under special situations where the pump(s) must be disassembled and the internal parts cleaned separately (see Subsection 4 3 3) For routine decontamination the following procedures will be followed

- Pump several pump volumes of a solution of a phosphate free laboratory grade detergent (e g Liquinox) and water through the equipment.

- Displace the soap solution immediately by pumping approved distilled water equivalent to 3 or more volumes of the pump storage capacity through the equipment.

- If any detergent solution remains in the pump continue pumping distilled water through the system until the detergent is no longer visibly present. Sudsing will be the common indicator used to determine incomplete rinsing

4 3 3 *Unusual Decontamination Requirements*

When equipment becomes grossly contaminated, such as from the collection of immiscible layer samples (see Subsection 4 5) routine decontamination of sampling equipment is not considered sufficient and thus is not allowed. This situation and other unusual equipment decontamination problems shall be reported to the field site supervisor Under certain circumstances a pump can be disassembled and the parts cleaned separately using approved solvents (i.e. hexane, alcohol, etc) If specific instructions are required, the field site supervisor will consult with an RMRS representatives for proper decontamination procedures

4 3 4 *Disposition of Decontamination Water*

All water generated during the decontamination of equipment used in contaminated or uncharacterized wells will be containerized in satellite tanks while in the field. These satellite containers will be emptied into larger trailer mounted containers designated as "high detect" and "uncharacterized" water, and temporarily stored for transport and discharged at a Consolidated Water Treatment Facility (CWTF) at RFETS (Refer to SOP RMRS/OPS-PRO 112, Handling of Field Decontamination Water and Field Wash Water). Routine decontamination water will be stored in containers mounted in the field vehicles. These will be emptied, as necessary, at a decontamination facility (B966 or B903A) as designated in SOP RMRS/OPS-PRO 112

4 4 Site Preparation

Sheet plastic may be used to protect clean equipment from contacting contaminated surfaces. Plastic bags and sheeting, along with the segregation of clean and dirty equipment, can be used to reduce the chances of cross contamination. If a mechanical bailer retrieval system is used, the amount of plastic appropriate for protection of sampling equipment may be lessened. The sample crewmembers will be responsible for determining the amount of plastic sheeting required.

Disposable nitrile gloves, or gloves made of other approved materials, will be used at all times when handling sampling equipment. Gloves will be changed between each site and as often as necessary to ensure the integrity of clean sampling equipment.

4 5 Collection of Immiscible Layer Samples

When specified in the Field Sampling Plan (FSP), or when the well to be sampled contains immiscible layers, immiscible phases must be collected before purging activities begin. The appropriate method for detecting these layers is discussed in SOP RMRS/OPS-PRO 105, Water Level Measurements in Wells and Piezometers. The method of choice for collecting non-aqueous phase liquids (LNAPLS) is a bottom valve bailer or peristaltic pump. Dense non-aqueous phase liquids (DNAPL) or "sinkers" will be collected with a bottom double check valve bailer or peristaltic pump

In all cases, the bailer will be carefully lowered into the well so that agitation of the immiscible layer is minimal. Any bailer used to collect immiscible layers will be dedicated to the well that is sampled. Peristaltic pumps will be equipped entirely with silicon, or other chemical compatible tubing, when sampling immiscible layers. The RMRS project manager will be responsible for determining the type materials to be used for specific projects. Dedicated equipment used for collecting immiscible layers will be decontaminated prior and after use as described in Subsection 4.3 of this SOP, if removed from the well. Immiscible layer sampling will be performed as follows

- Dedicated bailers will be removed from the well and decontaminated as specified in Subsection 4.3 of this SOP Dedicated pump tubing if used will also be decontaminated prior to use
- For LNAPLs, the bailer intake or sampling port will be carefully lowered to the midpoint of the immiscible layer and allowed to fill while it is being held at this level. The bailer must be lowered into the immiscible layer slowly so that minimal agitation of the immiscible layer occurs. Peristaltic pump intakes will also be lowered to the midpoint of the immiscible layer

- If a DNAPL laver is being sampled, either the double check valve bailer or peristaltic pump mav be used The bailer will be lowered into the well until bottom is encountered Peristaltic pump intakes will also be lowered to the well bottom Care must be taken not to immerse the pump intake into accumulated sediments

- At no time should the bailer or line be allowed to touch the ground or come in contact with other physical objects that might introduce contaminants into the well

- Immediately after sampling is completed, all equipment will be decontaminated. Dedicated bailers will be suspended in the well from the well cap The bailer will be suspended above the high water level Silicon tubing used with peristaltic pumps will be discarded.

4 6 Well Purging

Purging stagnant water from a well is required so that the collected sample is representative of the formation groundwater The device used (bailer or pump) depends upon aquifer properties individual well construction, and data quality objectives Wells which contain immiscible layers will not be purged unless specified in the site specific work plan Any well scheduled for purging and sampling that subsequently is found to contain immiscible layers must be reported to RMRS The RMRS project manager will be notified immediately prior to continued activities

Before obtaining water level elevations or initiating purge activities, obtain the following information in reference to the well to be sampled, and enter the applicable information on the sample collection log (Form PRO 113B or PRO 113C)

- Location code (well number)
- Previous purge volume (information only)
- Depth to top of screen (bailed wells only- Form PRO 113B)
- Well sample number
- RIN number (Report Identification Number)
- Sample event number

Record the location code (well number), date, sampling team members visitors well condition and any other pertinent information on the sample collection log Enter the well number time well is opened, and other information regarding the field activities on the Field Activity Daily Log (form No PRO 113A)

The field instruments will be standardized (to check calibration) and the results recorded on the sample collection form Instruments will be calibrated as described in SOP RMRS/OPS PRO 108 Measurements of Groundwater Field Parameters

Water level measurements will be collected as specified in SOP RMRS/OPS-PRO 105 Water Level Measurements in Wells and Piezometers Measure the depth to the top of the water column and the total depth of the well in order to determine the height of the water column in the well Calculate the well casing volume using the well casing inner diameter and the height of the water column in the well The formula for calculating the volume in gallons of water in the well casing is as follows

$(\pi r^2 h)\ 7\ 481$ = gallons where $\pi = 3\ 142$
r = inside radius of the well pipe in feet
h = linear feet of water in well
7 481 = gallons per cubic foot of water
1 gallon = 3785 ml

Calculations of the volume of water in typical well casings may be done as follows

a. 2" diameter well
0 16 gal./ft x ___ (linear ft of water) = gallons of water
b 4" diameter well.
0.65 gal./ft x ___ (linear ft of water) = gallons of water
c 3/4" diameter well.
87 mL/ft x ___ (linear ft of water) = milliliters of water

4 6 1 *Purging Duration*

Purging will be considered complete if any of the following conditions are met:

1 At least three casing volumes of water are removed from the well, and the last three consecutive pH, specific conductance, and temperature measurements do not deviate by more than the following: 1) pH =±0 1 pH units, 2) Specific Conductance = ±mS/cm and, 3) Temperature ±0.5°C A turbidity measurement will be taken for every other purge sample for wells that are purged using a bailer For wells that are equipped with a dedicated bladder pump, the turbidity will be measured each time the parameters are taken. The purge rate should be such that the turbidity is maintained at 5 NTU units or less (if possible). If the readings are not stabilized after three volumes, continue purging until stabilization or until five volumes have been removed. Field parameter measurements shall be collected after every half-casing volume (approximate) is removed from the well. When casing volumes are less than 1-liter, parameter measurements will be collected after each whole casing volume is removed. If readings do not stabilize after five well volumes have been recovered, obtain additional guidance from the RMRS project manager concerning the proper course of action.

2 A well is considered dewatered when only a few milliliters of water (or none) can be recovered each time the bailer is lowered into the well. When this occurs, a 10-minute recharge rate will be calculated (linearly) on form PRO 113B If, at the end of the 10-minute period, the well has not recovered sufficiently to continue the purge in thirty minutes, the purge is considered completed. If, at the end of the 10-minute period, there is sufficient water to collect the VOA samples, the samples may be collected at that time. If the well has not recovered sufficient water during the 10 minutes, and depending upon the well history, the samplers may elect to return to the well the same day (preferably within two hours), check the water level, and collect the VOA samples (first), and other samples as feasible If the sample team cannot return the same day, the well will be checked in twenty-four hours to determine if sample collection is feasible. If an extended period of time is required to collect samples the procedures in Subsection 4 8 1 will be followed. The well will not require an additional purge before sampling.

Wells that dewater (have a slow recharge rate as specified in 2 above) will not be restricted by parameter stabilization requirements. Sampling of these wells will follow the protocol established in Subsection 4.8

4 6.2 *Purging Methods*

Wells will be purged by either bailing or pumping. When purging a well, the rate of water withdrawal during purging should not exceed the rate of withdrawal at which the well was developed (if known) All purge times (initiation and completion) and the rate of purging will be recorded on the field log sheets

4 6 2 1 Bailing

Generalized procedures for purging a well with a bailer are as follows

- When purging a well with a bailer the site will be prepared as discussed in Subsection 4 4 Properly decontaminated equipment will then be used to determine the static water level of the well The total depth of the well will be measured. This information will be used to determine the volume of water in the well casing

- Prior to the initiation of purging all dedicated bailers will be decontaminated as described in Subsection 4 3 of this SOP

- A mechanical reel equipped with Teflon® coated stainless steel cable attached to a bailer is used for bailing and sampling operations The bailer will be slowly lowered into the well until water is encountered. Agitation of the well water will be minimized. Lowering the bailer to the bottom of the well will be avoided so sediments accumulated in the bottom do not become suspended. For wells that dewater the bailer should not be allowed to strike the well bottom with force The bailer will be raised ensuring that cable does not come in contact with any potentially contaminated surfaces The bailer should be raised and lowered slowly to limit surge energy Also the cable should not be allowed to drag along the well casing or against other objects that will cause fraying The amount of water purged will be monitored.

Wells with significant levels of contamination may have dedicated bailers installed. These wells will be selected by RMRS Dedicated bailer systems will consist of a Teflon® bailer with check valve or double check valve for DNAPLS and a 5-foot leader of Teflon® coated stainless steel cable Bailer sampling attachments and the stainless steel reel cable will not be dedicated to individual wells

Dedicated bailers will be decontaminated at the conclusion of sampling activities and suspended from the well cap above the high water table If the well interval above the high water table is not adequate to allow for storage in the casing the dedicated bailers will be stored in labeled and sealed plastic bags at the equipment trailer

4 6 2 2 Pumping

Pump designs that meet the following criteria are allowed for purging

- The pump is constructed of a material that does not introduce a source of contamination to the well

- The pump drive system does not introduce a source of contamination into the well

- All downhole parts to the pump can be easily decontaminated

- A return check system that does not allow pumped water to return to the well is integral in the pump design

- The pump is easily used and does not require excessive amounts of time to install, use, remove and decontaminate

The pumps currently in use to purge groundwater include peristaltic pumps and dedicated submersible bladder pumps A procedure for the use of each style of pump is specific to its applications User manuals, which accompany each pump will be referenced for operating procedures

Basic operating procedures common to all pumps are as follows

- Regardless of the type of pump being utilized, the site will be prepared as described in Subsection 4 4
- Wells utilizing peristaltic pumps will use properly decontaminated equipment to determine the static water level and the total depth of the well. This information will be utilized to determine the volume of water in the well casing
- Wells with dedicated pumps will use properly decontaminated equipment to determine the static water level of the well. The minimum purge volume is calculated using the pump storage volume and the volume of the discharge tubing. A total depth of a 2-inch well cannot be taken without the removal of the pump
- A dedicated pump will be positioned near the bottom of the well or positioned according to the information on the well construction form. The discharge rates and the amount of water purged will be monitored during purging. The pumping rate for purging can be higher than the pumping rate for sampling, however, the water level in the well should be monitored during purging to avoid excessive water level drawdown.
- Any tubing that enters the well casing should be composed of inert material. Disposable silicon tubing will be used in the drive mechanism of peristaltic pumps and discarded after each well is purged. The air supply for all air driven pumps (dedicated bladder pumps) will be free of oil (i.e., no hydrocarbon containing substances will be added to the compressor).

4 7 Field Parameters

SOP RMRS/OPS-PRO 108, Measurement of Groundwater Field Parameters, will be followed. The following field parameters will be measured during groundwater purging operations unless otherwise specified by the RMRS project manager

Parameter	Relative Precision	Minimum Calibration
pH	0 01 pH units	Daily
Conductivity	10 uS/cm	Daily
Temperature	0 1 °C	Weekly
Total Alkalinity (unfiltered)	1 mg/l	None
Turbidity (photometric)	2 FTU (or NTU)	Specified purge samples (bailed wells) Daily (dedicated bladder pump wells)

The measuring equipment will be stored and handled in a manner that will maintain the integrity of the equipment. Specific procedures and requirements for calibration and use of measuring equipment are given in SOP RMRS/OPS-PRO 108 Measurement of Groundwater Field Parameters. Appropriate field manuals will accompany each instrument in the field Each instrument will also be given an identification number All logbook and field form references to individual instruments will refer to this number for ease of identification.

Field parameters will be measured at the following intervals

- Conductivity pH temperature and turbidity will be measured from the first water removed from the well when initiating well purging procedures For bailed wells the initial bail of water will be carefully removed from the well and the water transferred to a sample beaker by decanting the bailer through a bottom control valve Wells purged with a peristaltic pump will similarly collect the first water removed in a sample beaker to be measured for parameters Wells with dedicated pumps will measure the parameters of the first recovered water that is collected in the continuous sampler

- During purging operations, conductivity, pH and temperature will be measured for every half-casing volume (one half of the initial casing volume as calculated on the sample collection log form) of water removed from the well (because of the accuracy of the graduated containers for the purge water the purge volume will be estimated as close as feasible) Wells that have half volumes less than the volume of a sample bailer (approximately 1 liter) will only have parameters measured after each full casing volume of water is removed from the well Turbidity will be measured on every other sample recovered for parameters for bailed wells, or wells purged with a peristaltic pump All parameters including turbidity will be measured at predetermined intervals while purging wells with dedicated pumps

- During purging, if a well is dewatered prior to the measurement of the final required set of parameters then conductivity, pH, temperature, and turbidity will be measured immediately before the start of sample collection These parameters may be delayed until sampling is completed if at the discretion of the sampling crew the well recharge has provided insufficient water volume to collect all the samples and also measure parameters If there is insufficient water for samples and field parameters, the parameters will not be measured.

- Total alkalinity measurements will be collected only once upon completion of purging For wells that do not dewater and sample collection proceeds to completion immediately after purging, alkalinity will be measured after the completion of all other final purge field parameters Wells that dewater and require repeated visits for the collection of samples will have alkalinity measured subsequent to the collection of the sample for inorganic water chemistry Alkalinity will not be measured if sufficient water is not available

- For micro purged wells a purge is considered completed when the parameters have stabilized.

- Whenever a method used to remove well water is changed, a set of field parameters will be recorded from water removed with the new method

4 8 Groundwater Sampling

Techniques used to withdraw groundwater samples from a well will be based on consideration of the parameters of interest The order of collection, collection techniques, choice of sample containers preservatives and equipment are all critical to ensure that samples are not altered or contaminated. The preferred methods for collection of groundwater samples are either bailing and/or the use of bladder pumps

4 8 1 *Sample Collection*

The following discussion involves collection of groundwater samples using bailers, and peristaltic or bladder pumps Regardless of the collection method, care will be taken not to alter the chemical nature of the sample during the collection activity by agitating the sample or allowing prolonged contact with the atmosphere In order to assist in minimizing the potential for altering the sample and maximizing the available water the following sample collection sequence is preferred

- Radiation Screening
- VOC
- Nitrate/Nitrite, as N
- Dissolved Metals - TAL, with Cs, Li, Sr Sn, Mo Si
- $^{239/240}$Plutonium, ^{241}Americium
- $^{233/234}$U, ^{235}U, ^{238}U
- Gross alpha and beta
- $^{89/90}$Strontium
- ^{137}Cesium
- ^{226,228}Radium
- Tritium
- Total Metals - TAL, with Cs, Li, Sr, Sn, Mo, Si
- TDS, CL, F, SO_4, CO_3, HCO_3
- TSS
- BNA
- Pesticides/PCB
- Cyanide
- Orthophosphate

Upon completion of purging, VOC samples will be collected first and as soon as possible after the well has been purged. If a well is purged using a peristaltic pump, then all other samples will be collected prior to removing the pump from the well The VOC sample will then be collected using a bailer

For wells that dewater if a sufficient volume of water for VOC sample collection has still not accumulated within 48 hours after the completion of purging, VOCs will not be collected for that well. Other samples may be collected using a maximum of five attempts to recover sufficient sample water for analysis. This procedure is discussed in the following paragraph.

The containers used for sample collection from poor producing wells may differ from those used for high yield wells in some instances due to constraints on obtaining enough sample to fill sample containers. In some instances smaller containers may be utilized, or analyte samples normally collected in separate containers may be combined into a single container Well histories can be used to identify which wells may require a modified sample suite and an extended sampling period. These wells will initially be sampled for a period of 48 hours after the completion of purging, with the exception of VOC sample collection, which is discussed in the previous paragraphs. The completion of purging will be considered 0 hour At the end of 48 hours, any partial sample will be measured. The accumulated sample will be compared to the minimum volume requirement identified in Table PRO 113-1, and the allowed sample holding time. If the minimum volume requirement for the target analyte has not been achieved, then sampling may continue as determined from the well recharge history An estimated sampling schedule will be determined, and the well will be visited for sampling according to this schedule but is limited to 5 visits per quarter All analyte samples that have only minimum sample volumes collected, and all uncollected samples will be documented on the sample collection log.

The order of sample collection may be changed at the discretion of the sampling team. Changes in the order that various analyte samples will be collected will be based on the predicted volume of water that will be recovered, and the priority stated in the controlling document. The sampling team will document their sample selections on the sample collection log.

Sample containers will be stored away from sunlight and will be cooled to 4°C prior to filling. Immediately after collection samples requiring cooling will be cooled to 4°C A chilled cooler will be used as the storage container Whenever a sample bottle that requires chilling is not being physically handled, it will be placed in the cooler to prevent heating or freezing exposure to sunlight, and possible breakage

VOC samples will be collected using a bailer equipped with a bottom-decanting control valve or directly from the pump discharge line on wells equipped with bladder pumps The procedures for collecting VOC samples are discussed in Subsections 4 8 11 and 4 8 1 2 of this SOP

VOC vials will never be filled and stored below capacity because of insufficient quantities of water in the well Except for the VOC vials, adequate air space should be left in the sample bottles to allow for expansion

Sites will be prepared prior to sampling as described in Subsection 4 4 All necessary and appropriate information will be recorded on the sample collection log (form PRO 113B or PRO 113C) and on the Field Activity Daily Log (form PRO 113A)

Samples will be placed in the appropriate containers and packed with ice in coolers as soon as practical VOC samples will be stored in the cooler in an inverted position immediately after collection Packaging, labeling, and preparation for shipment will follow procedures as specified in SOP RMRS/OPS-PRO 069 Containing, Preserving, Handling, and Shipping of Soil and Water Samples When sampling is complete the well cap will be replaced and locked.

Sampling tools instruments, and equipment will be protected from sources of contamination before use and decontaminated after use as specified in Subsection 4 3 Liquids and materials from decontamination operations will be handled in accordance with SOP RMRS/OPS-PRO 128, Handling of Purge and Development Water Sample containers will also be protected from sources of contamination. Sampling personnel will wear chemical-resistant gloves (e g nitrile) when handling samples Gloves will be disposed of between well sites

4 8 1 1 Groundwater Sampling Using a Bailer

This Subsection describes the use of a bailer for collecting groundwater samples that may be used to obtain physical chemical, or radiological samples

A bailer attached to a Teflon® coated stainless steel cable is carefully lowered into the well After filling within the well the bailer is withdrawn by rewinding the bailer line, and the bailer contents are drained into the appropriate containers Certain recommendations and/or constraints should be observed when using bailers for sampling groundwater quality monitoring wells

- Only bottom-filling Teflon® bailers or bailers made of other inert materials will be used
- Bailers will be attached to a Teflon® coated stainless steel line that is pre-wound on a reel
- Bailers constructed with adhesive joints will not be used

Lower the bailer slowly to the interval from which the sample is to be collected VOC samples will be collected using a bailer equipped with a bottom-decanting control valve The first water through the valve assembly will be discarded into the purge water container Vials will be filled by dispensing water through the control valve along the inside edge of the slightly tilted sample vial. Care will be taken to eliminate aeration of the sample water The vials will be filled beyond capacity so the resulting meniscus will produce an airtight seal when capped The capped vial will be checked for trapped air

TABLE PRO 113-1
SAMPLE CONTAINERS AND PRESERVATIVES FOR GROUNDWATER SAMPLES

PARAMETER	MINIMUM CONTAINER[1]	PRESERVATIVE	HOLDING TIME
Radiation Screen	120 ml poly	None	NA
VOC - CLP	3 - 40ml amber glass	Cool to 4°C	14 Days
BNA	1 L amber glass	Cool to 4°C	7 Days
Pesticides/PCB	1 L amber glass	Cool to 4°C	7 Days
TSS	125 ml poly	Cool to 4° C	7 Days
TDS Cl, F, SO_4, CO_3, HCO_3	1 L poly	Cool to 4°C	7 Days
DissolvedMetals - CLP, with Cs, Li, Sr, Sn, Mo, Si	1 L poly	*Filtered, HNO_3 to pH <2, Cool to 4°C	6 Months
TOC	125 ml poly	H_2SO_4 < pH2 Cool to 4°C	28 Days
COD	125 ml poly	H_2SO_4 < pH2 Cool to 4°C	28 Days
Total Metals - CLP with Cs, Li, Sr, Sn, Mo, Si	1 L poly	Unfiltered, HNO_3 to pH <2, Cool to 4°	6 Months
Orthophosphate	250 ml poly	Filtered, Cool to 4° C	2 Days
Nitrate / Nitrite as N	250 ml poly	H_2SO_4 to pH <2, Cool to 4°C	28 Days
Cyanide	1 L poly	Na OH to pH >12, Cool to 4°C	14 Days
Gross Alpha / Beta	550 ml poly	HNO_3 to pH <2	6 Months
$^{233/234}U$ ^{235}U ^{238}U	100 ml poly	~~Filtered,~~ HNO_3 to pH <2	6 Months
$^{239/240}Pu$	1 L poly	HNO_3 to pH <2	6 Months
^{241}Am	1 L poly	HNO_3 to pH <2	6 Months
$^{89/90}Sr$	700 ml poly	Filtered, HNO_3 to pH <2	6 Months
$^{226/228}Ra$	750 ml poly	Filtered, HNO_3 to pH <2	6 Months
^{137}Cs	2 5 L poly	Filtered, HNO_3 to pH <2	6 Months

[1] The volume listed is the minimum amount required for analysis Actual sample volumes may be slightly higher and some parameters may be combined in a single container

* Some samples may not require filtering if taken from a well with a dedicated pump and turbidity of 5 NTU or less.

by lightly tapping the vial in an inverted position If air becomes trapped in the vial the sample water will be discarded, and the vial will be refilled If two consecutive attempts to fill a VOC vial result in trapped air bubbles the vial will be discarded

The remainder of the sampling water will be collected in a stainless steel container from which the remaining sample bottles will be filled Samples requiring filtration will be filtered and then containerized

4 8 1 2 Groundwater Sampling Using a Peristaltic Pump

Use of peristaltic pumps will generally be limited to collecting sample aliquots for radionuclides metals and other species that are not subject to volatilization and degassing Peristaltic pumps will never be used to collect VOCs or other volatile species in routine wells, although such samples may be collected for special screening applications All downhole tubing will be Teflon® except in areas of special concern (e g where immiscible layers exist) where special tubing, such as stainless steel or Viton®, may be required. If so this will be determined and provided by the RMRS project manager Only the portion of tubing that is inserted into the mechanical drive will be made of silicon This drive portion of the tubing will be discarded after each use

4 8 1 3 Groundwater Sampling Using a Downhole Bladder Pump

Several wells at RFETS have been equipped with dedicated downhole bladder pumps for purging and sampling of the wells These are wells that will normally produce an adequate amount of water during a single visit to complete the required sampling suite The equipment required to purge and sample a well consist of a pump control unit, a portable air compressor a continuous sampler for measuring the field parameters (see SOP RMRS/OPS-PRO 108) and the necessary sample containers graduated cylinders, and container(s) to collect the purge and excess water The following precautions should be observed during the sampling operation

- The compressor used to power the pump will be located downwind from the well to eliminate the contamination of equipment and samples with exhaust

- If the flow-through cell will not maintain a full sample chamber (tends to drain back) then the check valve on the pump is fouled and needs to be cleaned, or the pump replaced.

- The minimum purge volume is routinely calculated using the formula on Form PRO 113C However a purge is considered completed only when the groundwater parameters have stabilized.

- Upon completion of purging, sampling should be initiated with the collection of the VOC sample(s) The pump should operate with minimum interruptions while the full sample suite is collected Allowing the pump to stop for an extended period of time will cause the water trapped in the discharge lines to equilibrate to ambient temperatures which is not acceptable During sampling, the pump can be slowed to any rate that allows efficient sampling while also maintaining stable field parameters

- Groundwater parameters will be measured periodically during sample collection and recorded on Form Pro 113C to document conditions during sampling

- Because micropurging is the method used for sampling, the flow rate should be adjusted to limit the drawdown in the well The rate should also be adjusted such that the turbidity is below 5 NTU for sampling If this is met, the samples need not be filtered.

- The pump, pump control unit, and the flow-through cell will be operated according to the manufactures recommendations

4 8 1 4 Groundwater Sampling Using a Push Type Sampler

This portion of this SOP describes the use of a Geoprobe® Screen Point 15 Groundwater Sampler, or similar type equipment, for collecting groundwater samples at predetermined depths. These samples may be used to obtain physical, chemical, or radiological analyses

A Geoprobe® Screen Point 15 Groundwater Sampler, or equivalent tool, is driven to a predetermined depth by a push type-sampling rig. The Screen Point 15 Groundwater Sampler is equipped with a 41-inch retractable screen and expendable drive point. It can then be partially or fully withdrawn (up to 41 inches) to expose a portion or the entire deployed well screen. After groundwater enters the exposed screen, a sample is collected using either the procedures in Subsection 4 8 1 1 Groundwater Sampling Using a Bailer, or in Section 4.8.1.2, Groundwater Sampling Using a Peristaltic Pump Note that these samples are collected only for screening purposes because the sampling tool hole has not been completed as a well

The method for obtaining QC samples using the push type-sampling tool will follow the method described in Subsection 4 8 4 1 for groundwater sampling. Duplicate groundwater samples will be collected only if there is enough water to collect two full suites of analytes without dewatering the annulus. If insufficient water is available for the collection of a planned QC sample, it well be explained and documented in the field log book, and the RMRS Project Manager will be informed about any deviation from the planned QA/QC sampling goals. If insufficient water is available for two full suites of analytes, it may be come necessary to prioritize the analyte list. The prioritization sequence should be described in the project specific work plan.

4 8.2 *Sample Filtering and Preservation*

Samples for dissolved metals, Gross Alpha/Beta, $^{233/234}$Uranium, ^{235}Uranium, ^{238}Uranium, $^{89/90}$Strontium, ^{137}Cesium, ^{226}Radium, ^{228}Radium, and orthophosphate will be filtered in the field at the well location during the sampling event through a disposable 0 45-micrometer membrane filter If a peristaltic or bladder pump is being utilized, a disposable filter may be attached directly to the sample delivery line so that the sample is filtered directly into the sample container as it exits the delivery line Discharge pressure will be gauged so it does not exceed 50 psi. Alternatively, sample water may be collected in a stainless steel container and filtered with a peristaltic pump Before sample collection, 100 to 200 milliliters of sample water will be passed through the filter in order to rinse the filter and filtration apparatus of possible contaminating substances

Preservatives will be added to the sample bottles prior to the introduction of the filtered sample water The preservative will be added in aliquots appropriate to the size of the bottle. After sample collection has been completed the pH of preserved samples will be checked as follows.

- A small amount of sample will be poured from the sample bottle directly onto approved pH paper Care will be used so that the threaded neck of the bottle does not contact the pH paper Under no circumstances should the pH paper be inserted into the sample bottle

- The pH paper will be checked against the supplied color chart. If the appropriate pH has not been achieved, additional preservative will be added to the sample in 5ml aliquots, and the pH test will be repeated.

4 8 3 *Sample Screening*

A sample for radiation screening will be collected for each well sampled, unless the sampling history for any specific well shows that the samples meet the radiation screening requirements for shipping and analysis The radiation screen is usually collected during the sampling event and may be obtained from the purge water prior to completion of purging This sample will be delivered to the RMRS or subcontracted radiation screening laboratory to be screened for gross alpha. Samples from the corresponding well will be handled according to the levels of radioactivity detected in the sample as specified in SOP RMRS/OPS-PRO 069 Containing, Preserving, Handling, and Shipping Soil and Water Samples

4 8 4 *QA/QC Samples*

The frequency and types of field QA/QC samples collected during groundwater sampling are described in RMRS-QAPD-001 Quality Assurance Program Description. This document details the applicable criteria for collecting QA/QC samples

4 8 4 1 Duplicates

Duplicate samples will be collected only from wells that produce enough water to collect two full suites of analytes without dewatering The wells which produce sufficient water will be incorporated into the sampling program such that the required duplicate frequency can be maintained.

Wells scheduled for duplicate sample collection will be sampled as described in Subsection 4 8 of this SOP and in Subsection 3 5 1 Appendix 3 RMRS-QAPD-001 Quality Assurance Program Description. Field duplicates are collected following the same sampling procedures used to obtain the real samples With the exception of VOCs the typical procedure for a location is to collect the real and duplicate of each sample at the same time in two equal portions, with each portion going to the laboratory in separate containers This is accomplished by alternately filling two sample bottles one half at a time to minimize heterogeneity Procedure RMRS-QAPD-100 states the real and duplicate VOC samples will be collected independently to reduce the possibility of volatilization of the sample

When a well with a dedicated pump is being used for sample collection, all samples will be collected in the normal order with duplicate VOC samples being collected first. The remaining samples will be sampled as described above

If a well is being used for matrix spike (MS) and matrix spike duplicate (MSD) samples the duplicate will be collected after collection of the MS and MSD

All duplicate samples will be given a sample number different from the original sample and the information recorded on form PRO 113-D, Field QC Groundwater Sample Collection Log

4 8 4 2 Matrix Spike and Matrix Spike Duplicate

MS and MSD samples will be collected only from wells that produce enough water to collect the required suites of analytes without dewatering MS and MSD samples are not collected on a routine basis, but will be collected if so designated in a site specific sampling plan, or if requested by the RMRS project manager

MS and MSD samples will be collected as follows

- The well will be purged as described in Subsection 4 6 of this SOP

- After completion of purging, VOC samples will be collected. The real sample will be collected followed by the MS and MSD These samples will be collected in immediate succession

- The remaining parameters not requiring filtering will be collected. For each sample parameter, the original sample, MS, and MSD will be collected concurrently The original sample bottle will be filled one-third full followed by the MS and MSD sample bottles, which will also be filled one-third full. Each bottle will be rotated in the sequence, filling in one-third full until all three bottles are full. For analytes not requiring a MSD, only the original sample and the MS will be collected.

- After the real sample, MS, and MSD (where appropriate) are collected for one parameter, the process will be repeated for the next parameter

- Parameters requiring filtering will be collected similarly When a bailer is used, a stainless steel bucket will be filled with sample water. As samples are collected and the reservoir of water in the bucket is depleted, additional water may be added at the discretion of the sample crew When a pump is used, the filter will be attached directly to the discharge line Sample bottles will be filled as described above, partially filling the original sample, MS, and MSD in rotating sequence until each parameter bottle is full.

- Radiochemistry samples may have more than one bottle for each parameter group In this case, all required bottles will be included in the rotating sequence

- Field parameter measurements will not be required for MS and MSD samples.

- MS and MSD samples will retain the original sample number However, a suffix of MS or MSD will be added to the sample number to correspond with each QA/QC sample All information will be recorded on form PRO 113D Field QC, Groundwater Sample Collection Log.

4 8 4 3 Replicates and Splits

Replicate and split samples will be collected in the same manner as described for the MS and MSD Replicates and splits exceeding three samples will be referred to RMRS for further instructions All information will be recorded on form PRO 113-D

4 8 4 4 Field Equipment Rinses

Wells scheduled for equipment rinsate samples will be sampled as described in Subsection 4 8 of this SOP, and field equipment rinses will be collected as described in this Subsection, and in Subsection 3.5.2, Appendix 3, RMRS-QAPD-001 Field equipment rinses will be collected in a manner designed to reflect sampling techniques. All equipment used during sampling will be fully decontaminated as described in Subsection 4.3, then rinsed with distilled or deionized water The rinse water will then be collected in bottles identical to those used for the original sample, and assigned a separate sample number Analytes requiring filtration will be filtered using a new filter and tubing as required for the real sample. All information will be recorded on form PRO 113D, Field QC, Groundwater Sample Collection Log.

4 8 4 4 1 *Bailed Wells*

After completion of sampling, all equipment will be decontaminated. Prior to leaving the well location, the equipment rinse will then be collected as follows.

- The bailer will be filled with distilled or deionized water by pouring the water into the top opening

- The rinse water should then be decanted to the VOC vials through the bottom valve This will be done in the same manner used during sample collection

- For the remaining unfiltered samples, the bailer will be filled with distilled or deionized water each time additional rinsate is needed. The rinsate will then be transferred to sample bottles or to a stainless steel bucket and then to sample containers in the same manner used during collection

- Filtered samples will also be collected in an identical manner as the real samples The bailer will be filled with distilled or deionized water The rinse water will then be transferred to a stainless steel bucket. The rinse water in the bucket will then be filtered through a new disposable filter

- Rinse samples will be preserved in the same manner as the real samples

4 8 4 4 2 *Pumped Wells*

Rinsate samples are not routinely collected from wells that are equipped with dedicated bladder pumps because the samples from these wells are collected directly from the pump discharge line However wells sampled using peristaltic pumps for sampling may be selected for rinsate sampling, with equipment used in sample collection (down hole tubing, filter tubing and the stainless steel bucket used for sample water collection, etc) being decontaminated prior to rinsate sampling The tubing at the pump head will be replaced, and a new filter used for filtered analytes To collect the samples, distilled or deionized water will be poured into the decontaminated stainless steel bucket and pumped, using the decontaminated tubing into the sample containers The equipment used to collect the real VOC samples will also be decontaminated, rinsed, and used to collect the VOC rinse samples All samples will be preserved at the same pH levels as the real samples

4 8 4 5 Distilled Water Blanks

Distilled water sample blanks are not submitted on a routine basis but will be made up if so designated in a site specific sampling plan, or if requested by the RMRS project manager Samples of the distilled or deionized water used for the final decontamination of equipment will be transferred directly to sample bottles to determine any baseline contamination the water may have introduced into the samples Five gallon bottles of the distilled or deionized water water will be opened in a controlled area, such as the bottle storage room and then poured directly into the appropriate sample bottle A Teflon® glass, or stainless steel funnel may be used to help control flows into small mouth bottles Blank samples will be preserved to the appropriate pH required for each analyte All information will be recorded on form PRO 113D, Field QC, Groundwater Sample Collection Log

4 9 Sample Handling and Control

Pre cleaned sample containers will be obtained from the contract analytical sample container source Preserving solution will be added to the bottles by a laboratory the sample manager or qualified personnel at the sample trailer The bottles will be labeled to indicate the preservative added.

The sampling containers preservation requirements, and holding times for the various types of analyses are shown in Table PRO 113 1 Additional information on containerizing, preserving, and handling of the water samples is given in SOP RMRS/OPS-PRO 069 Containing, Preserving, Handling, and Shipping Soil and Water Samples Groundwater samples will be properly labeled so that they can be easily identified. The sample numbering system has been assigned by RMRS A sample identification (ID) number will be assigned to each sample suite The sample ID number will contain the following information as part of a nine to twelve character, alpha-numeric code

Character(s)	Description	Code
1 and 2	Project ID	GW
3 through 7	Sample Number	00001 to 99999
8 and 9	Subcontractor ID	Alpha (e g. TE = Tierra Environmental Consultants)
10, 11, and 12	QA/QC	MS for matrix spike, MSD for matrix spike duplicate

In addition to a sample number, each well sampled will be assigned a current Record Identification Number (RIN), an event number (specific to the RIN), and bottle numbers that are specific to the RIN and event number

5.0 RECORDS

All field activities will be recorded on Form PRO 113A, Field Activity Daily Log; Form PRO 113B or PRO.113C Groundwater Sample Collection Log, depending on the method used to sample the well (bailer or dedicated pump); Form PRO 113D if a QC sample is collected, and Form PRO 113E, Well Status Form. Summary information of the day's activities or other pertinent information should always be recorded on the field forms. Under special circumstances the RMRS Project Manager may assign a bound field logbook to the field personnel which will remain in their custody during all sampling activities The cover of each logbook will contain the following information at a minimum.

- Name of the organization to which the book is assigned
- Book number
- Project name
- Start and end dates

Logbook pages will be sequentially numbered and marked with the book number before any data recording. All data and information pertinent to field sampling will be recorded in the logbook or on the field forms that identify all required data entries. Enough detail must be included in the documentation to reconstruct the sampling event. Field form entries will include the following minimum information.

- Date and time
- Names of field personnel
- Names of all visitors
- Location of field activities
- Description of sampling sites including weather conditions
- All field observations and comments
- Field parameters
- Sample identification information
- References to all prepared field activity forms and chain-of-custody records

Field logbooks when required on specific projects will normallv be kept only by the field sampling team leaders and the site supervisor and will typically be used only to summarize field activities and to document project information not required bv the SOP field forms

Logbooks will be maintained and entries made in accordance with procedure 2 S47 ER ADM- 05 14 Use of Field Logbooks and Forms Permanent ink will be used for all entries in the logbooks and on the field forms Mistakes will be crossed out with a single line, initialed, and dated. Unused pages or partial pages will be voided by drawing a line through the blank sections that is initialed and dated. Any deviation from this SOP will require documentation in the site supervisor's logbook

The field activity daily log narrative should create a chronological record of the sampling team's activities, including the time and location of each activity Descriptions of problems encountered, personnel contacted, deviations from the SOP and visitors on site should also be included. The weather conditions date signature of the person responsible for entries, and the number of field activity daily log sheets used to record media team activities for a given day will also be included.

The Groundwater Levels Measurement/Calculations Form (see SOP RMRS/OPS-PRO 105 Water Level Measurements in Wells and Piezometers) and the Chain of Custody Record (see SOP RMRS/OPS-PRO 069 Containing Preserving Handling, and Shipping Soil and Water Samples) will also be completed for each site All blank fields on the forms must be completed or voided.

6 0 REFERENCES

6 1 Source References

The following references were reviewed before this procedure was written

Environmental Protection Agency, 1982 *Test Methods for Evaluating Solid Waste SW-846 Volume II Field Methods* 2nd edition

Environmental Protection Agency 1986a, *Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual* EPA Region IV Environmental Service Division

Environmental Protection Agency, September 1986b, *RCRA Ground Water Monitoring Technical Enforcement Guidance Document* OSWER-9950 1

Environmental Protection Agency, 1987a, *A Compendium of Superfund Field Operations Methods* EPA/540/P-87/001 1987

Environmental Protection Agency, 1987b *Data Quality Objectives for Remedial Activities Development Process* EPA/540/G 87/003

Environmental Protection Agency December 1988 *User's Guide to the Contract Laboratory Program*

6 2 Internal References

Related SOPs cross-referenced by this SOP are as follows

- RMRS-QAPD-001 Quality Assurance Program Description (QAPD)
- 2-S47-ER-ADM-05 14 Use of Field Logbooks and Forms
- SOP RMRS/OPS-PRO 069 Containing, Preserving, Handling, and Shipping Soil and Water Samples
- SOP RMRS/OPS-PRO 105, Water Level Measurements in Wells and Piezometers
- SOP RMRS/OPS-PRO 106, Well Development
- SOP RMRS/OPS-PRO 108, Measurement of Groundwater Field Parameters
- SOP RMRS/OPS-PRO 112, Handling of Field Decontamination Water and Field Wash Water
- SOP RMRS/OPS-PRO 127, Field Decontamination Operations
- SOP RMRS/OPS-PRO 128, Handling Purge and Development Water
- SOP RMRS/OPS-PRO 141, Decontamination Facility Operations
- SOP FO 11, Field Communications
- SOP FO 14, Field Data Management

APPENDIX A

STANDARD GROUNDWATER FORMS

Form PRO 113A

Revision 0

U S DEPARTMENT OF ENERGY
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

DATE	
SHEET	OF

FIELD ACTIVITY DAILY LOG

PROJECT NO

RFETS PROJECT GROUNDWATER SAMPLING PROGRAM

FIELD ACTIVITY SUBJECT

DESCRIPTION OF DAILY ACTIVITIES AND EVENTS.

Air Monitoring Ins __________ Water Level Ind __________ Field Parameter Kit:__________ Solomat No ______

VISITORS ON SITE	OKAY (OK)	SUPPORTING DOCUMENTS
		A DATE-
		B DATE-
		C WELL ID -
WEATHER CONDITIONS		D DATE-
		OTHER
	A PRO 105A , WATER LEVEL MEASUREMENT B: AIR MONITORING	
	C PRO 113B,PRO 113C, and/or PRO 113D SAMPLE COLLECTION LOG(S)	
	D PRO 113E, WELL STATUS LOG	

SAMPLING TEAM PERSONNEL

SIGNATURE OF PREPARER DATE

PROJECT NAME ______ DATE(S) ______ ______
PROJECT CHARGED ______ SUB-CONTRACTOR ______
SAMPLE NUMBER ______ TEAM LEADER ______
LOCATION CODE ______ MEMBER (S) ______
D ______ ANALYTE CODE ______
N NUMBER ______ EVENT NUMBER ______
QA/QC ______ Date ______ ☐ 1 Day Well ☐ 2 Day Well ☐ 3 Day Well

Equipment Type	Equipment Identification	Standard Used Lot Number	Temp (°C)	Equipment Reading	Reading Acceptable?	Date	Time
Conductivity							
pH Meter							
Turbidity Meter							

Air Monitoring	Background	Well Bore	Headspace	Other____	Instrument	Comment
Day 1						
Day 2						
Day 3						

Purge Method - Type Used ☐ Peristaltic Pump ☐ Bailer (☐ Teflon ☐ SS) ☐ Other ______

PURGE VOLUME CALCULATION - DATUM TOP OF WELL CASING (TOWC) Date ______

Well Casing Inside Diameter (in) = ______(ID) Unit Casing Volume (Gal/Foot) = ______(UV)
Depth to Water (Ft) = ______(WD)
Measured Total Depth ______(MTD) + Probe End (Feet)______ = Total Depth (Feet) ______(TD)
TD ______ - WD ______ = Initial Water Column (Feet) ______(IC)
UV ______ X IC ______ = Initial Water Volume (Gallons) ______(IV)
3 X IV = Purge Volume (Gallons) ______(PV)
(Check Calculations Before Starting Purge) Checked By (initials) ______

PURGED VOLUMES AND FIELD WATER QUALITY MEASUREMENTS

Time (24-hour)	Volume Purged (Gallons or ml)	Temp (°C)	pH (SU)	Specific Conductance ☐ms/cm or ☐ µs/cm	Turbidity ☐FTU ☐ NTU	Water Description Color	Water Description Odor
	Initial						

Does the well dewater? ☐ Yes ☐ No If Yes perform recharge rate calculation If No Enter Purge Volume and Sample Well
Actual Purged Volume = ______ Units Gallons or ml _

RECHARGE RATE CALCULATION

0 9 X (IC)______ = ______(90% of Initial Water Column)
10 Minute Water Level Recovery Start Time ______ End Time ______
TD ______ - (10 Minute Water Depth ______)(X3) = ______ Estimated 30 Minute Recharge (ER)
Is ER less than 90% of IC? ☐ Yes ☐ No If yes purge is completed If no continue with purge sequence

Is water level above top of screen? ☐ Yes ☐ No If yes continue with the following calculation
Depth to Top of Screen ______ - 2 Ft = Screen Depth ______(SD)
TD ______ - SD ______ = Adjusted Water Column ______(AC)
X AC ______ = 90% of AC
ER less than 90% of AC? ☐ Yes ☐ No If yes purge is completed If no continue with purge sequence

Depth to Water Before Sampling (2nd visit)______ Wtr Col ______%Rchrg ______ Date______ Time______
Depth to Water Before Sampling (3rd visit) ______ Wtr Col ______%Rchrg ______ Date______ Time______

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ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

Form PRO 113C (Rev 0)

SAMPLE COLLECTION LOG FOR DEDICATED PUMP SYSTEM

Sample # ______________________ **Date** ______________________

Location Code ______________________ **Time** ______________________

Project Charge # ______________________ **Sample Team Member** ______________________

Grid ______________________ **Member(s).** ______________________

Access Restrictions ____________ **RIN** ____________ **EVENT** ________ **Analyte Code** ________

QA/QC ____________ **Date** ________ **Contractor** ______________________

Purge Calculations **Pump Depth =** ____________ **Water Depth =** ____________

Pump Pressure = $\frac{\text{Pump Depth}}{2} - \frac{\text{Water Depth}}{2} + 15 =$ ________ *

*Pressure settings usually lower

Purge Volume = Pump Volume (300 ml) + Sample Cup Volume (200 ml) +Tubing Volume (10 ml/ft), Tubing = ____ft

Purge Volume (1x) = 300 ml + 200 ml + __________ **ml =** ______________ **ml total**

Air Monitoring	Background	Well Bore	Headspace	Comments,
Mini-Rae #				

Pump Settings Purge

Pres.(psi)	Fill Time	Pump Time	Enhncd Fill	Vent Time	Start Time	Stop Time	Color	Odor	Vol. Collect.

Total Purged Volume = ______________

Water Quality Measurements: Purge and Sample

Pres. (psi)	Time	Temperature (°C)	pH	Conductivity (µS/cm)	Turbidity (NTU)	Volume	Water Depth

Pump Settings Sampling

Pres. (psi)	Fill Time	Pump Time	Enhncd Fill	Vent Time	Start Time	Stop Time	Volume	Water Depth

Checked by ______________________ **Date** ______________________

U S DEPARTMENT
OF ENERGY

Form PRO 113 D
Revision 0

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
FIELD QC
GROUND WATER SAMPLE COLLECTION LOG

PROJECT NAME ____________ DATE ____________

PROJECT CHARGED ____________ SUB-CONTRACTOR ____________

SAMPLE NUMBER ____________ SAMPLE TEAM LEAD ____________

LOCATION CODE ____________ MEMBER(S) ____________

RIN NUMBER ____________ EVENT NUMBER ____________

QA/QC ____________ DATE ____________ ANALYTE CODE ____________

SAMPLE PARAMETER MEASUREMENTS

TEMP (°C)	pH (SU)	CONDUCTIVITY (mS/cm)	TURBIDITY (FTU or NTU)*	DATE	TIME	INITIAL

* Hach = FTU/Solomat = NTU

- [ ] DUPLICATE
- [ ] EQUIP. RINSE
- [ ] FIELD BLANK
- [ ] TRIP BLANK
- [ ] MS
- [ ] MSD

ANALYSIS	VOLUME	PRESERVATIVE	FILTER	LINE ITEM CODE	BOTTLE #	DATE	TIME	LAB	SHIP DATE
Rad Screen	120 ML POLY	None		OS01A002					
VOA	(GL) 3 X40	4°C		SS01B009					
TDS SO4 F	1 liter	4°C		SS06B034 SS06B037 SS06B018					
TDS SO4	1 liter	4°C		SS06B034 SS06B037					
TDS	1 liter	4°C		SS06B034					
Nitrate/Nitrite	250 ml	4°C / H_2SO_4		SS06B022					
Dissolved Metals	1 liter	4°C / HNO_3	filter	SS05B007					
Total Metals	l liter	4°C / HNO_3		SS05B001					
PU/AM	1 gallon	HNO3		RC01B012 RC01B007					
Tritium	(GL) 100 mL	None		RC02B001					
U Isotope	1 liter	HNO_3	filter	RC01B017					
Total Sr	1 liter	HNO_3	filter	RC05B001					
OTHER									
OTHER									

COMMENTS ____________

Completed by (Print Name) ____________ Signature ____________ Date ____________

Checked by (Print Name) ____________ Signature ____________ Date ____________

WELL STATUS FORM

RIN # ______________________

DATE ______________________

TEAM MEMBER (1) ______________________

TEAM MEMBER (2) ______________________

ALTERNATE MEMBER (3) ______________________

		ANALYSIS	VOA	RAD SCREEN	U-ISO	DISS METAL	NITRATE /NITRITE	TDS SO_4, F	TDS SO_4	TDS	Pu/Am	TRIT	Sr 89/90	Total Metals			
		VOLUME	(3) 40 ml	120ml	1 LITER	1 LITER	250 ml	1 LITER	1 LITER	1 LITER	1 GALL. (2.5L)	100 ml	1 LITER	1 Liter			
		PRES	HCl	NONE	HNO_3	HNO_3	H_2SO_4	NONE	NONE	NONE	HNO_3	NONE	HNO_3	HNO_3			
		FILTER	NO	NO	YES	YES	NO	NO	NO	NO	NO	NO	YES	NO			
	PURGE	TEMP	4°C			4°C	4°C	4°C	4°C	4°C				4°C			
WELL #	DATE	EVENT #															

x_1= day one x_2= day two x_3= day three x_4= day four x_5= day five x_6=day six